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Questionnaire identification of ear pathology in children

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QUESTIONNAIRE IDENTIFICATION OF EAR PATHOLOGY IN CHILDREN

By

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CHAPTER I

INTRODUCTION

The early detection of hearing impairments and ear disease in children is an important aspect of any school hearing conservation program. Nevertheless, every year many children with ear problems go undetected. At the Symposium on Conservation of Hearing in Children, 1971, a proposed answer to this problem was that a thorough medical examination, as well as audiometric testing, is necessary to identify all children with ear problems.

The Pittsburgh study (Eagles, Wishik, and Doerfler, 1963) found that the majority (79.8 percent) of cases of ear disease were discovered for the first time between the ages of five and ten years, with 24.1 percent of those cases detected during ages five and six. This would clearly indicate the importance of the pre- and early school age as a time in which a significant number of cases of ear disease do develop or at least are found.

The most common finding in 70 percent of these children with ear disease was the presence of adhesive otitis media and/or impaired function of the Eustachian tube. Approximately half of the children with ear disease showed no decrease in hearing sensitivity at the time of the discovery of their ear disease. These children would thus be missed under routine audiometric testing. On the other hand, a decrease in hearing sensitivity does not always accompany

the discovery of significant ear disease needing active medical teatment. Thus, it would appear that hearing level in a case of ear disease does not necessarily indicate the acuteness of the need for medical treatment and vice versa.

There are, however, a number of medical history events which, while they also may occur in children without ear disease, for example, earache, ear discharge, allergies, sinus complaints, and bronchitis, do occur with greater frequency in children with disease and are, therefore, of predictive value in indicating those children who might need special attention. Eagles, et. al., (1967) report that otoscopically abnormal children had 60 percent more earaches than otoscopically normals and had three times as many instances of ear discharge as normals.

Problem and Purpose

In his discussion on screening the hearing of pre-school and school age children, Anderson (1972) reports that conventional audiometric screening has been used to reveal not only those children with "hearing loss" but also those with ear conditions needing medical care. Eagles, et. al., (1967) indicate, however, that screening audiometry for handicapping hearing loss misses a large percentage of children with demonstrable otoscopic abnormalities (61.7 percent of those with ear disease and 80 percent of those children who were classified as having unsatisfactory visibility of the eardrum showed hearing levels as sensitive as children without such evidence).

Melnick, Eagles, and Levine (1964) found that the hearing test results, both for screening and the threshold test procedures, did not identify 70 percent of the children with evidence of past otological difficulty or 48 percent of those with active pathology. "Audiometric testing, however complete it may be, cannot identify all children with physical abnormalities which may have predictive value, or who may need medical treatment" (Eagles, et. al., 1967).

Some other procedure is needed to identify children needing special otological and audiological attention. Eagles (1971) points out that it should be imperative and inevitable that an otological examination performed by a physician be an intrinsic aspect of all hearing conservation programs. Needless to say, this would be financially impractical and unduly time consuming on the part of the examining physician. Thus, it becomes important to ask whether other alternatives exist. For example, what other signs and occurrences exist in the life and development of a child which may identify him as a child in need of special otological and audiological attention?

It is realized that a number of factors limit the accuracy and usefulness of histories obtained from parents. Despite this, Eagles, et. al., (1967) insist that the history is still an important factor in indicating those children who need special otological and audiological attention. They suggest that, by answering a few pertinent

questions about their child's development, parents could assist the school health services and speech pathology and audiology team by alerting them to potential hearing problems of their child. The feasibility of using such a questionnaire could be substantiated by having children in the study population examined otologically, or evaluated with the electroacoustic impedance bridge which approaches and occasionally exceeds the efficiency of the otoscopic examination in identifying middle ear pathology (Alberti and Kristensen, 1970; Feldman, 1963). A comparison of the results could then be made with the answers on the questionnaire to see what relationship there is, if any, to the presence of middle ear pathology.

According to Brooks (1971), the electroacoustic impedance bridge is "a practicable, reliable, and clinically useful method of examining the middle-ear function in children". The impedance bridge is simple to operate and a full examination can be completed in a few minutes without the need for special preparation of the subject, special facilities, or even a quiet room. The electroacoustic impedance bridge offers a method of obtaining specific information on the status of the middle and external ear that was previously only available through exploratory surgery or at least direct otoscopy.

Research Hypothesis

The hypothesis is made that the information obtained from parents by a questionnaire could have predictive value in indicating those children in special need of otological and audiological attention because there is an association between the responses on the questionnaire and the finding of conductive mechanism problems as indicated by the results of middle ear impedance measurements.

CHAPTER II

PROCEDURES

Subjects

The study sample was chosen from 200 children and their parents who attended the Missoula County Department of Welfare Title 19 health screening program at the University of Montana Health Services Clinic. A total of 186 were Medicaid patients. The ages of these children ranged from one to seven years. A tympanogram was obtained on each child using the Madsen Electroacoustic Impedance Bridge Model #ZO-70. From the results, two groups were established, one group containing those children whose tympanograms were normal bilaterally and the other containing those children whose tympanograms indicated an external or middle ear pathology.

Tympanometry

The Madsen #ZO-70 Electroacoustic Impedance Bridge was employed as the measuring instrument. Manual plottings were used to display the compliance/pressure function.

The measuring probe of the instrument is inserted into the ear canal of the subject such that an airtight seal is obtained. This is verified by increasing the pressure in the meatus and observing the stability of the manometer. Any leak is rapidly detected by the fall in pressure. Within the meatus the only structure that is to any degree susceptible to changes in pressure is the tympanic membrane.

As sound enters this pressure controlled cavity (220Hz tone), the degree of sound absorption by the tympanic membrane and/or reflection from the tympanic membrane has a direct relationship to the stiffness factor of the tympanic membrane. The greater the stiffness, the less the absorption of incoming sound by the tympanic membrane. The stiffer the tympanic membrane in this controlled, hard-walled cavity, the greater the impedance of this tympanic membrane to the sound source. The less stiffness of the tympanic membrane the greater ease of transmission of sound through to the middle ear, or the greater compliance. With a pressure difference of 20 cc H_2O or greater, the drum and middle-ear system become effectively rigid and the compliance observed is a minimum. Thus, the compliance C_1 measured with a pressure load on the drum of 20 ccH_2O is essentially that of the volume of air enclosed in the meatus. Compliance C_2 measured when the pressures on both sides of the drum are equal so that the membrane is free from stress, is the compliance of the middle ear and the meatal air. The difference between C_1 and C_2 represents the compliance attributable to the middle ear at that frequency of 220Hz (Brooks, 1971).

The examiner was a qualified audiologist on the staff at the University of Montana Speech and Hearing Clinics. A senior student in Speech Pathology and Audiology at the University assisted in plotting the compliance/pressure tympanograms.

Classification of tympanograms as to those that are normal or those that indicate external or middle ear pathology were according to Jerger (1970). Classification was done by a graduate student in speech pathology and audiology under the supervision of a staff audiologist at the University Speech and Hearing Clinics.

Questionnaire

Each parent accompanying the child through the screening procedures was asked to complete a questionnaire (see Appendix A). An explanatory letter (see Appendix B) accompanied the questionnaire. The writer was available to the parent to clarify or to answer any questions raised by the parent.

The questions asked are essentially those used in the study by Eagles, et. al., (1963). In comparing the frequency of occurrence of selected events from medical histories of children classified as otoscopically normal and abnormal, their study revealed little difference in frequency reported by the two groups (between 0 percent to 9 percent) on the following: Colds, influenza, sore throats with fever, certain manifestations of allergy, sinus complaints and/or bronchitis, dizziness and/or ringing in the ears, and head or ear injuries. However, the consistent trend was that more of the children reporting these events generally had less sensitive hearing patterns and showed greater variation from year to year, namely, ranges from minus 7dB to plus 20dB.

The Eagles, et. al., (1963) study did, however, find marked differences evident in the experience of the two groups with conditions directly related to disease of the middle ear, such as earache, ear discharge, and ear operations (questions 12, 13, and 14). Fifty percent of the otoscopically abnormal children were reported to have had earaches as compared with 38 percent of the normal group. Fourteen percent were reported having ear discharge as compared with 4.9 percent of the otoscopically normal. Eardrum operations were reported by 6.3 percent of the abnormal children as compared to 1.8 percent of the normal group.

CHAPTER III

RESULTS

The data for the study was collected according to the procedures described in Chapter II. Of the 200 children who attended the screening clinic, 130 were selected as the study sample, 82 with abnormal tympanograms and 48 with normal tympanograms. The remainder were rejected because either a tympanogram was not obtained due, in part, to the fact that children younger than three years are difficult to test, or because the questionnaire was not returned. These non-returns were evenly distributed between the normal and abnormal tympanogram groups. The distribution by age and sex of the children is listed in Table I.

A tabulation of events recorded in the developmental histories of the study population and their frequency is presented in Appendix C. The largest proportion of "no response" was given to questions relating to the age of first speech, indicating that such information was not easily recalled.

Certain categories of events with low prevalence were not fully analyzed. Among these were some experiences in the ante- and post partum period, some diseases of childhood as well as questions relating to the child's speech, and hearing impairment in the family. The questions relating to where the parent and child have lived since the child's birth could not be analyzed as it was apparent they were often either confusing to or misunderstood by the parent.

TABLE I

Distribution by Age and Sex of Children Aged 1-7 Years in the Study Population Classified According to their Tympanograms.

	Normal				Abnormal				
Ages	Girls	Boys	No.	Pct.	Girls	Boys	No.	Pct.	Total
1	-	1	1	2.1	2	3	5	6.1	6
2	4	2	6	12.5	7	8	15	18.3	21
3	5	5	10	20.8	14	12	26	31.7	36
4	9	7	16	33.3	9	9	18	22.0	34
5	4	6	10	20.8	9	4	13	15.9	23
6	-	2	2	4.2	2	3	5	6.1	7
7	1	2	3	6.3	-	-	-	-	3
Total	23	25	48	100.0	43	39	82	100.0	130

The responses to three questions in the prenatal and birth history section of the questionnaire yielded interesting results. In the normal tympanogram group seven (14.6 percent) of the mothers indicated having taken medication during her pregnancy compared to 22 (26.8 percent) in the abnormal group. Two mothers (4.2 percent) in the normal group indicated having a kidney disease during her pregnancy in contrast to thirteen (15.9 percent) in the abnormal group. Six mothers (12.5 percent) in the normal group said they had experienced at least one unsuccessful pregnancy prior to the birth of the child as compared to the report by nineteen mothers (23.2 percent) in the abnormal tympanogram group.

With respect to the question dealing with common diseases of childhood, the children in the normal tympanogram group experienced diseases such as measles and chicken pox more often than those in the abnormal tympanogram group. This disparity was also observed in the study by Eagles, et. al., (1963). In that study, the consistency with which children in the better hearing group showed a greater frequency of these common childhood diseases could not be explained at the time the analysis was performed, unless age was a factor.

Fourteen children (17.1 percent) of the abnormal tympanogram group were reported with sinus complaints compared to three children (6.3 percent) in the normal tympanogram group. Asthma was reported for six children (7.3 percent) in the

TABLE II

Frequency of Reports of Selected Events in the Developmental Histories of Children in the Study Population Classified by Tympanogram.

Developmental Event	Normal		Abnormal	
	No.	Pct.	No.	Pct.
All Children	48	100.0	82	100.0
Ear Conditions Ever Reported				
Earache	25	52.1	47	57.3
Ear Discharge	4	8.3	17	20.7
Ear Drum Operation	1	2.1	3	3.7
Never Reported Any Ear Condition	23	47.9	35	42.7
Frequency of Reports of Ear Conditions				
Five or More Earaches	4	8.3	19	23.2
Three or More Ear Discharges	-	-	7	8.5

abnormal group whereas none of the normal group reported this ailment.

Reports of earache appear proportionately distributed between the two groups (see Table II). However, there is a significant difference with regard to the frequency of five or more earaches being reported: four children (8.3 percent) in the normal group and nineteen children (23.2 percent) in the abnormal tympanogram group - a discrepancy of 14.9 percent between the groups.

In the normal tympanogram group, four children (8.3 percent) reported the occurrence of ear discharge although none of the children were reported to have experienced ear discharge more than twice. In contrast, seventeen children (20.7 percent) in the abnormal tympanogram group had experienced ear discharge, with seven children (8.4 percent) reported to have experienced three or more.

Regarding the question on respiratory conditions in the preceding twelve months, 16.5 percent more of the children in the normal tympanogram group report having had sore throats with fever. However, the frequency of three or more colds were reported by 62.2 percent of the abnormal tympanogram group as compared to 56.3 percent of the normal group.

None of the normal tympanogram group reported that colds and related illness had increased as compared to 6.1 percent in the abnormal group that reported an increase (see Table III). Fifty percent of the normal group indicated that the frequency

TABLE III

Frequency of Reports of Selected Events in the Developmental Histories of Children in the Study Population Classified by Tympanogram.

Developmental Event	Normal No.	Normal Pct.	Abnormal No.	Abnormal Pct.
All Children	48	100.0	82	100.0
Respiratory Conditions in Preceding 12 months				
Sore Throat with Fever	29	60.4	36	43.9
Three or more Colds	27	56.3	51	62.2
None of the above reported	1	2.1	1	1.2
Frequency of Colds and Related Illness				
Increased	-	-	5	6.1
Decreased	19	39.6	21	25.6
Remained the same	24	50.0	48	58.5
Unknown	5	10.4	8	9.8

of colds and related illness had remained the same compared to 58.6 percent in the abnormal group. 39.6 percent of the normal group reported a decrease of colds and related illness as compared to 25.6 percent in the abnormal group, a discrepancy of 14.0 percent between the groups.

Marked differences are evident in the experience of the two groups of children classified with normal and abnormal tympanograms. In order of percentage discrepancy between the groups, the first five questions that are associated with abnormal tympanogram results are listed in Table IV.

To determine if there is a significant difference in the results between the normal tympanogram and abnormal tympanogram groups, a chi-square test of independence was used on each question (Guildford, 1965). The 0.10 level of significance was used, with one degree of freedom. The Yates Correction Factor for continuity was employed when the expected figure for any one cell was less than ten. According to Siegel (1956), the correction is necessary because a continuous distribution (chi-square) is used to approximate a discrete distribution and when all expected frequencies are small, that approximation may be poor. The correction for continuity is an attempt to remove this source of error.

On the question dealing with reports of five or more earaches, the obtained chi-square value is 3.65. This is significant at the 0.10 level. Chi-square values obtained on the questions dealing with ear discharge, sinus complaints

TABLE IV

Percentage discrepancy between normal and abnormal tympanogram groups and chi-square results.

	Pct.	Chi-square
Reports of five or more earaches ..	14.9	3.65
Ear discharge	12.4	2.66
Sinus complaints	10.8	2.27
Asthma	7.3	2.17
Frequency of colds and related illness having increased	6.1	1.52
Three or more colds in preceding 12 months	5.9	.42

and asthma were significant at the 0.20 level. The remaining questions were significant at or less than the 0.30 level.

CHAPTER IV

DISCUSSION

In this study the most significant health history event associated with an abnormal tympanogram is the frequency of five or more earaches being reported. Reports of ear discharge or ear drum operations are always reported accompanied by earache. Worthy of mention are the parents' responses when asked to estimate how many times altogether had the child had earache. Mothers of children classified with an abnormal tympanogram often responded with "several" or "numerous". A mother of a two-year old indicated her child had "as many as twenty or more", and the mother of a three-year old wrote "steady for two years", while the mother of a six-year old said her child had experienced "hundreds" of earaches. The mother of a three-year old estimated the frequency of ear discharge as "steady for long periods". In contrast, of the mothers of the children classified with normal tympanograms only one, a mother of a two-year old, indicated that earache accompanied "every cold".

Eagles, et. al., (1967) have cautioned that parents' answers to questions pertaining to prenatal and birth history are unreliable. Nevertheless, the findings of this study suggest that there is a tendency for a greater number of mothers of those children classified in the abnormal tympanogram group to indicate having taken medications, having suffered from kidney disease, or to having experienced one

or more unsuccessful pregnancies prior to the birth of the child. A discrepancy of over ten percent on each question is shown between groups. Admittedly, the number reported in each question is extremely small and is not statistically significant. However, authors such as Whetnell and Fry (1971), suggest that such maternal illness or abuse can, and will, have adverse effects on the unborn child.

On the question asking if the child now has any of the seven current ailments listed, sinus complaints were reported by a greater, though not statistically significant, number of children classified in the abnormal tympanogram group. Asthma was another ailment reported by only the abnormal tympanogram group. These conditions could have been, in part, a function of the particular environment of the Missoula area. Air pollution from sources as industrial waste emissions, automobile emissions and other pollutants that are occasionally trapped in the air because of the particular interaction between geographic contours and weather of this area may contribute to the incidence of health problems of this region. No research is available to support this observation at this time, but a study is presently underway examining hospital admissions for upper respiratory problems in which ear problems will be carefully examined. It is assumed that the outcome of this study will enhance any questionnaire used in a hearing conservation program by finding whether other

developmental events in the child's life have predictive value in indicating potential ear problems.

The question dealing with the increase in frequency of colds and related illness seems an important one to ask as it is not only related to the questions dealing with earache and ear discharge but it encompasses other events such as sore throats and/or fevers. Although over 60 percent of the normal tympanogram group reported having had sore throats with fever in the preceding twelve months compared to 43.9 percent of the abnormal group and the frequency of three or more colds in the preceding twelve months did not differ significantly between the groups, the normal tympanogram group indicated that the frequency of colds and related illness had either decreased or remained the same, but none indicated they had increased. In the abnormal tympanogram group 6.1 percent indicated an increase.

In the longitudinal study by Eagles, et. al., (1967) it was noted that the majority of cases of ear disease were discovered during the first study year, particularly with those children who entered the study at five or six years of age. After entering school, children showed a variation in the annual increment of new cases which probably was, in a large part, related to the average annual prevalence of upper respiratory disease. They found that cases of ear disease reported for the first time rise from a low of 4.3 percent at ages two to four up to 18.5 percent at age eight.

The percentage falls off progressively with advance in years. However, the greatest annual increments of ear disease were most frequently discovered for the first time at ages five through ten.

The findings by Eagles, et. al., (1967) and the results of this study suggest that a follow-up or longitudinal study should be conducted on the 130 children in the study population. Of particular interest would be the answers that would be given by those in the normal tympanogram group to questions dealing with earache, ear discharge, ailments such as sinus infections and asthma, and whether the frequency of colds and related illness had increased.

It is impossible to state what effect medical treatment will have had on the trend seen in this study. Undoubtedly, it will have an effect since the majority of children identified as having ear disease and/or a decrease in hearing sensitivity were seen by a physician and in many cases, were referred for audiological and otological evaluation and treatment.

This study demonstrates the necessity of developing identification and management of children with ear disease and hearing problems in the pre-school years. One procedure that could be used in such identification screening is a questionnaire.

There are a number of developmental events which, while they also occur in children without ear pathology, do occur

with greater frequency in children with abnormal tympanograms and are, therefore, of predictive value in indicating those children in need of otological and/or audiological attention.

A questionnaire containing the four questions found to be most significantly associated with abnormal tympanogram results could be used in the school health records and the information could be placed on the child's school medical file. It might be regarded as an alerting device to the school health services that this child may be more likely to have or develop hearing problems.

The use of such a questionnaire does not replace audiometric data or audiological and/or otological evaluation. It appears to be an efficient way of letting the school medical services know that the child has the potential of developing hearing problems because of the answers the parents have given concerning his development.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of the study was to ascertain whether there were developmental events which might have predictive value in indicating those children in special need of otological or audiological attention. Data were collected on 130 children, aged one to seven years, at the time the questionnaire was completed by the parent and an electroacoustic impedance tympanogram was obtained on the child between March 19 and 21, 1973.

The study population were from similar socio-economic background in that they were families on welfare, and were adequately representative on the basis of sex.

A tympanogram was obtained on each child using the Madsen #ZO-70 Electroacoustic Impedance Bridge. Classification of tympanograms as to those that are normal bilaterally or those that indicate middle or external ear pathology were according to Jerger (1970).

The information obtained from the developmental histories through a questionnaire completed by the parent were studied for each group and compared.

A history of both earache and ear discharge appears to be associated with negative tympanogram results more often than if only earache was reported. Reports of sinus infection and indications of an increase in the frequency of colds and related

illness were also associated with results of an abnormal tympanogram.

The chi-square analysis of data tends to support the following conclusions:

1. There is an association between some of the responses on the questionnaire and the findings of conductive mechanism problems as indicated by the results of impedance measurements.
2. Answers obtained from parents through the use of a questionnaire, particularly the frequency of earache reported and occurrence of ear discharge, may have predictive value in indicating those children in need of otological and audiological attention.

Examination of the data tends to suggest that there are four questions that will assist the school health services and speech pathology and audiology team during audiometric screening procedures by alerting them to potential hearing problems of that child. They are:

	No	Yes
1. About how many times altogether has the child had earache?		
Less than five	___	___
Five or more	___	___
2. About how many times altogether has this child had discharge from the ears?		
None	___	___
Less than three	___	___
Three or more	___	___

	No	Yes
3. Does this child now have any of the following?		
Sinus infection	___	___
Asthma	___	___
4. Have the frequency of his colds associated with sore throats, and/or fever increased?	___	___

This study demonstrates the following:

(a) The necessity of developing identification and management of children with ear disease and hearing problems in the pre-school years.

(b) There are a number of developmental events which, while they also occur in children without ear pathology, occur with greater frequency in children with abnormal tympanograms and are, therefore, of predictive value in indicating those children in need of otological and/or audiological attention.

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APPENDIX A

UNIVERSITY OF MONTANA
Speech and Hearing Clinic

Survey of Hearing in Children

Child's Name: _____ Home Address: _____

Birth Date: _____ Male:____Female: ___ School:_____Grade:___
Month Day Year

Name of Father: _____ Occupation: _____

Name of Mother: _____ Occupation: _____

Name of Child's Physician _____ His address: _____

Please make a check mark ( ) in one of the columns headed YES, NO, DONT KNOW, to give the answer to the following questions.

		Yes	No	Dont Know
1.	Did the child's mother have any of the following during the time she was pregnant with this child?			
	a. Kidney Disease	____	____	____
	b. High Blood Pressure	____	____	____
	c. German Measles in the first 3 months of pregnancy	____	____	____
	d. Any other acute illness with fever in the first 3 months of pregnancy	____	____	____
	e. A complication affecting herself or this child which the physician said was due to the Rh factor	____	____	____
	f. Prescription medications (Name below)	____	____	____
	_____			
2.	Did the mother have any blood transfusions prior to this pregnancy with this child?	____	____	____
3.	Did the mother have any immunizations in the 18 months preceding this pregnancy? Describe below.	____	____	____
	_____			
4.	Has the mother ever been addicted to alcohol or drugs?	____	____	____
5.	Has the mother ever had any unsuccessful pregnancies prior to having this child? If Yes, please list number. _____	____	____	____
6.	In the first few weeks after birth did this child have jaundice? (Was his skin yellow)	____	____	____
7.	Did this child have a blood transfusion in the first few days after he was born?	____	____	____
8.	Did this child have any injury during his birth? If Yes, describe below. _____	____	____	____

9. What did this child weigh at birth? ____lbs ____oz.

10. Do you know anyone of the child's relatives who couldn't hear well before they were 50 years of age? Think hard about all of your family and the father's family.

	Yes	No	Dont Know
	___	___	___

_____Father _____Brother _____Grandparent ____ Uncle
_____Mother _____Sister _____Aunt _____ Cousin
_____ Other

How old is the person now _____
How old was he when the loss occurred _____
Was the hearing loss treated _____
If so, how _____

11. HAS THIS CHILD EVER HAD ANY OF THE FOLLOWING? (Whenever the answer is YES, please give child's age in years when the condition occured or was first noticed)

		Age when first noticed
a.	Measles	
b.	German Measles	
c.	Mumps	
d.	Scarlet Fever	
e.	Whooping Cough	
f.	Meningitis	
g.	Encephalitis (brain fever)	
h.	Epilepsy	
i.	Tuberculosis	
j.	Cerebral Palsy	
k.	Diphtheria	
l.	Chickenpox	
m.	A head injury with (1) unconsciousness	
	(2) bleeding from nose	
	(3) bleeding from ears	
n.	Injury to the ears. (Describe using one line for each injury)	

	Right ear	Left ear	
1.			
2.			
3.			

o.	Tonsil or Adenoid operation	
p.	Mastoid operation	
	(1) on right side _____	
	(2) on left side _____	
q.	Sinus operation (in the nose)	

12. HAS THIS CHILD EVER HAD EARACHE? No:_____ Yes:_____
If Yes, a. How old was the child the first time? _____
b. How old was the child the last time? _____
c. About how many times altogether has the child had earache? _____(Your best estimate)

13. HAS THIS CHILD EVER HAD A DISCHARGE FROM THE EARS? No:_____ Yes:_____
If Yes, a. How old was the child the first time? _____
b. How old was the child the last time? _____
c. About how many times altogether has this child had discharge from the ears? _____(Your best estimate)

14. HAS THIS CHILD EVER HAD ANY EARDRUM OPERATION? No: ____ Yes:_____
If Yes, a. How old was the child the first time? _____
b. How old was the child the last time? _____
c. How many such operations did this child have? _____
d. Which eardrum was operated on? Right:___ Left:___ Both:___

15. DOES THIS CHILD HAVE SORE THROATS WITH FEVER? No:____ Yes:____
If Yes, a. When was the most recent time? _____
b. How many such sore throats did this child have during the past 12 months? _____(Your best estimate)

16. HOW MANY COLDS DID THIS CHILD HAVE DURING THE PAST 12 MONTHS? _____
a. When was the most recent cold? _____

17. DOES THIS CHILD NOW HAVE ANY OF THE FOLLOWING?

	Yes		Yes
a. Sinus trouble (nose)...	___	e. Hay fever	___
b. Bronchitis	___	f. Asthma	___
c. Dizziness	___	g. Eczema	___
d. Ringing in the ears ...	___	h. Hives	___
		i. Allergy to any food, medication	___

18. HAVE THE FREQUENCY OF HIS COLDS AND RELATED ILLNESS

	Yes	No	Dont Know
a. Increased	___	___	___
b. Decreased	___	___	___
c. Remained about the same..	___	___	___

19. HOW LONG HAVE YOU LIVED IN THE MISSOULA AREA? _____

20. WHERE DID YOU LIVE BEFORE THIS SINCE THIS CHILD'S BIRTH? _____

21. DO YOU KNOW OR SUSPECT THAT THIS CHILD HAS A HEARING IMPAIRMENT? No: ____ Yes: _____
If Yes, a. Please explain why you think so.

_____

b. Did a physician say that this child was hard of hearing? No: ____ Yes: _____

22. If this child speaks differently from other children of his age will you please make a check mark ( ) in the Yes column opposite those terms which describe his speech.

		Yes
a.	Too soft	___
b.	Too loud	___
c.	Too slow	___
d.	Too fast	___
e.	Repeats words	___
f.	Says wrong sounds	___
g.	Leaves off parts of words	___
h.	Stutters	___
i.	Hoarseness	___
j.	Other (Please describe)	___

_____

23. Have any of the following ever been consulted about the way this child speaks?
a. a physician _____
b. a specialist in hearing disorders _____
c. a specialist in speech disorders _____

24. How old was this child when
a. he first spoke single words? _____
b. he first spoke words together? _____

Signed: _____
Parent or Guardian

Date: _____
Month Day Year

APPENDIX B

University of Montana
Speech and Hearing Clinic

19 March, 1973.

Dear Parent,

This letter is to tell you about a survey we are conducting in the form of a questionnaire to find children who may have hearing losses, or a family or developmental history indicative of possible hearing problems. We would appreciate your help in this study. Your answers will help us give your child the best possible care. Although some of these questions may seem unrelated to hearing and speech, your answers can be of help in identifying those children in need of special medical attention.

If these questions cause you concern, please feel free to discuss them with the undersigned at any time. You may be assured that this information will be treated as confidential and will be kept in the clinic's files. If used for the purposes of the survey, the data will have no names attached.

Please complete this questionnaire and return it to the clinic. Thank you.

Ann Bowden
Research Assistant

APPENDIX C

Tabulation of Events in the Developmental History of Children Aged 1-7 Years in the Study Sample.

Event	Normal		Abnormal	
	No.	Pct.	No.	Pct.
All Children	48	100.0	82	100.0
Prenatal and Birth History				
Kidney Disease	2	4.2	13	15.9
High Blood Pressure	9	18.8	14	17.1
Other acute illness with fever in first trimester	-	-	1	1.2
RH Complication	2	4.2	2	2.4
Prescription medications	7	14.6	22	26.8
Blood transfusion of mother	-	-	1	1.2
Immunization in 18 months prior to pregnancy	-	-	2	2.4
Addiction to Alcohol or Drugs	2	4.2	3	3.7
Unsuccessful pregnancies prior to birth of this child	6	12.5	19	23.2
Jaundice of child	3	6.3	9	11.0
Birth injuries	2	4.2	4	4.9
Blood transfusion of child	-	-	1	1.2
Birth Weight				
Less than 3 lbs. 8 oz.	1	2.1	-	-
3 lbs. 8 oz. - 4 lbs. 7 oz.	1	2.1	2	2.4
4 lbs. 8 oz. - 5 lbs. 7 oz.	5	10.4	4	4.9
5 lbs. 8 oz. - 6 lbs. 7 oz.	9	18.8	15	18.3
6 lbs. 8 oz. - 8 lbs. 15 oz.	26	54.2	51	62.2
9 lbs. or more	4	8.3	6	7.3
Unknown	2	4.2	4	4.9
Diseases of Childhood				
Measles	12	25.0	13	15.9
German Measles	2	4.2	2	2.4
Mumps	3	6.3	8	9.8
Scarlet Fever	2	4.2	2	2.4
Whooping Cough	1	2.1	3	3.7
Meningitis	1	2.1	1	1.2
Encephalitis	-	-	1	1.2
Epilepsy	1	2.1	-	-
Diptheria	-	-	1	1.2
Chicken Pox	11	22.9	14	17.1
Head Injury with Unconsciousness	2	4.2	1	1.2
Head Injury with Bleeding from Nose	2	4.2	1	1.2
Injury to Right Ear	-	-	2	2.4
Tonsil and/or Adenoid Operation.	3	6.3	5	6.1
Sinus Operation	-	-	2	2.4

Developmental History (contd)

Event	Normal No.	Normal Pct.	Abnormal No.	Abnormal Pct.
All Children	48	100.0	82	100.0
Earaches	25	52.1	47	57.3
First under 3 years of age	23	47.9	33	40.2
First at 3 years or older	2	4.2	11	13.4
Age Unknown	-	-	3	3.7
Ear Discharge	4	8.3	17	20.7
First under 3 years of age	4	8.3	14	17.1
First at 3 years or older	-	-	3	3.7
Age Unknown	-	-	-	-
Operation on Eardrum	1	2.1	3	3.7
Sore Throats with Fever in Past 12 Months				
None	19	39.6	36	43.9
1-2	15	31.3	20	24.4
3-4	8	16.7	9	11.0
5-8	1	2.1	4	4.9
9-12	1	2.1	1	1.2
13 or more	-	-	1	1.2
Number unknown	4	8.3	11	13.4
Colds in Past 12 Months				
None	6	6.3	5	6.1
1-2	15	31.3	24	29.3
3-4	17	35.4	35	42.7
5-8	4	8.3	10	12.2
9-12	1	2.1	2	2.4
13 or more	-	-	1	1.2
Number unknown	5	10.4	5	6.1
Current Ailments				
Sinus Trouble	3	6.3	14	17.1
Bronchitis	3	6.3	3	3.7
Ringing in Ears	1	2.1	1	1.2
Hay Fever	2	4.2	2	2.4
Asthma	-	-	6	7.3
Eczema	2	4.2	5	6.1
Allergy to Food, Medication	7	14.6	13	15.9
Hard of Hearing				
No	41	85.5	67	81.7
Yes - only suspected by parent	6	6.3	11	13.4
Yes - confirmed by M.D.	1	2.1	3	3.7
Unknown	-	-	4	4.9

Developmental History (contd)

Event	Normal		Abnormal	
	No.	Pct.	No.	Pct.
All Children	48	100.0	82	100.0
Speech Differences	20	41.7	32	39.0
Too Soft	4	8.3	8	9.8
Too Loud	8	16.7	7	8.5
Too Slow	1	2.1	3	3.7
Too Fast	5	10.4	7	8.5
Repeats Words	4	8.3	7	8.5
Says Wrong Words	8	16.7	10	12.2
Omits Parts of Words	4	8.3	5	6.1
Stutters	1	2.1	4	4.9
Hoarseness	1	2.1	1	1.2
Other	1	2.1	5	6.1
Consultations Regarding Speech				
M.D.	1	2.1	1	1.2
Hearing Specialist	4	8.3	2	2.4
Speech Specialist	3	6.3	2	2.4
More than One Specialist	3	6.3	2	2.4
Age First Spoke Single Words				
Before 8 months	4	8.3	11	13.4
8-10 months	8	16.7	15	18.3
11-14 months	10	20.8	23	28.0
15 months or later	8	16.7	18	22.0
Unknown	18	37.5	15	18.3
Age First Spoke Words Together				
Before 13 months	13	27.1	13	15.9
13-24 months	13	27.1	37	45.1
25-35 months	4	8.3	4	4.9
3 years or later	-	-	5	6.1
Unknown	18	37.5	23	28.0
Hearing Impairment in the Family	18	37.5	36	43.9
Frequency of Colds and Related Illness				
Increased	-	-	5	6.1
Decreased	19	39.6	21	25.6
Remained the Same	24	50.0	48	58.5
Unknown	5	10.4	8	9.8